Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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FULL CONTENTS

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(57) [Claim(s)]
[Claim 1] The process of the process of hot forging (rolling) and heat treatment as solution treatment to a precipitation-hardening type molding material, The manufacture method of the mold material for continuous casting characterized by performing processing treatment in the procedure of the process of the warm forging (rolling) of 2 to 50% of working ratio, or cold forging (rolling), the process of heat treatment as aging treatment, and the process of the warm forging (rolling) of 2 to 50% of working ratio, or cold forging (rolling).
[Claim 2] the Claims characterized by repeating the process of heat treatment as aging treatment, and the process of the warm forging (rolling) following it, or cold forging (rolling) once [at least] among said each process -- the manufacture method of the mold material for continuous casting given in the 1st term.

[Detailed Description of the Invention]
[Industrial Application]
This invention relates to the manufacture method of the mold material for continuous casting. In addition, if it is in an application concerned, "warm forging (rolling)", cold forging, or cold rolling may be expressed [hot forging or hot-rolling] for "hot forging (rolling)", warm forging, or warm rolling as "cold forging (rolling)" for convenience.
[Description of the Prior Art]
The mold material excellent in heat-resistant modification or a heat-resistant fatigue crack is called for

for the betterment of extension of the life of the mold for continuous casting, or cast piece quality.
To these claims, this invention person etc. developed previously the precipitation-hardening type mold material of a Cu-nickel-Be system which had high intensity, high temperature conduction, etc., and has offered it (JP,S63-3940,B).
The manufacture method of the conventional mold material for continuous casting is manufactured in order of each process of hot forging (rolling) and heat treatment (solution treatment and aging treatment), or is manufactured in order of each process of hot forging (rolling), heat treatment (solution treatment), cold forging (rolling), and heat treatment. In addition, aging treatment performs heat treatment suitable after rapid cooling (solution treatment), and means the treatment to stiffen.
[Problem(s) to be Solved by the Invention]
However, although high temperature strength of the copper alloy of the conventional precipitation-hardening type mold material improved from chromium copper or chromium zirconium copper and improvement was accepted also in heat modification prevention of a mold, heat conductivity fell with the alloying element and there was a problem that mold temperature rose. The increase of thermal stress generated in a mold and hardening which especially holds the hardness of a mold material at an elevated temperature are not fully obtained, and the rise in heat of a mold has a possibility of causing heat-resistant modification and a heat-resistant fatigue crack.
This invention was made in view of the above actual condition, and aims at offering the manufacture method of the mold material for continuous casting that the mold material of high intensity is obtained without decline in heat conductivity.
[Means for Solving the Problem and its Function]
[the manufacture method of the mold material for continuous casting by this invention for attaining the above-mentioned object] The process of the process of hot forging (rolling) and heat treatment as solution treatment to a precipitation-hardening type molding material, It is characterized by performing processing treatment in the procedure of the process of the warm forging (rolling) of 2 to 50% of working ratio, or cold forging (rolling), the process of heat treatment as aging treatment, and the process of the warm forging (rolling) of 2 to 50% of working ratio, or cold forging (rolling).
[Function]
According to this, as compared with a conventional method, a betterment of an ingredient is made remarkably, and extremely, hardness becomes large and serves as an ingredient with high toughness equipped with the elongation stabilized also at the elevated temperature. It is not necessary to add the third element for high-intensity-izing, and lifting of mold temperature can be controlled from this. Generally about this point, electric conductivity (%I.A.C.S.) falls with the third element which adds a precipitation-hardening type molding material for high-intensity-izing. Electric conductivity has heat conductivity and the relation of direct proportion, and the heat conductivity of the high thing of "% I.A.C.S." is also good. % The heat conductivity of the low thing of I.A.C.S. is also low. Therefore, lowering of %I.A.C.S. is decline in heat conductivity, and will cause lifting of mold temperature.
The precipitation-hardening type molding materials with which this invention is presented are all the

copper alloy ingredients which harden by the heating rapid cooling (solution treatment) back at an elevated temperature, and can be hardened by heating cooling (aging treatment) at low temperature from the characteristics which enable the application. For example, it is considered as the alloy which used Cr-Cu, Cr-Zr-Cu, Cu-nickel-Be-Zr, Cu-nickel-Be, Cu-nickel-Si, Cu-Be-Co, Cu-Ti, and other elements as the base.

It is possible by repeating the process of heat treatment as aging treatment, and the process of the warm forging (rolling) following it, or cold forging (rolling) once [at least] among said each process for an effect to become still more remarkable and to obtain a strong higher mold material. However, if the number of times of a repeat is increased, since a hardness rise is not carried out that workability worsens with a hardness rise, and considering the number of times of a repeat, about 1 time of a repeat is suitable for them.

[An example and a comparative example]

The manufacture method of the molding material according [the 1st table] to this invention, and the electric conductivity after manufacture (%I.A.C.S.), The conventional manufacture method as a comparative example and its electric conductivity are shown, and Fig. 1 , Fig. 2 , and Fig. 3 show the numerical value which compared the elevated-temperature tensile strength, high temperature proof stress, and elevated-temperature elongation with a curve chart, as a result of doing the performance test in an elevated temperature about the molding material of the example of representation of them.

A molding material is a copper alloy which consists of Cr0.8%, Zr0.2%, and ** Cu.

For an understanding of a table and a graph (Fig. 1 or Fig. 3), suitable operation of this invention is explained roughly.

** The copper plate of arbitrary cross-sectional configurations is first built with the temperature of 800-900 degrees C by hot forging (or hot-rolling).

** This copper plate carries out heating cooling at the temperature of 1,000 degrees C succeedingly (solution treatment).

** further -- the temperature (warm forging or warm rolling) of 500 degrees C or less -- decrease the area of the cross section of a copper plate 2 to 50% at a room temperature (cold forging or cold rolling) preferably (preferably 30%).

** Heating cooling of this copper plate is carried out at the temperature of 500 degrees C (aging treatment).

** after that -- again -- the area of the cross section of a copper plate -- warm forging (warm rolling) of 500 degrees C or less -- it is cold forging (cold rolling) in a room temperature preferably, and make it decrease 2 to 50% (preferably 30%)

** And a strong higher copper plate can be obtained by repeating the process of **.

第 1 表

	製造方法	導電率
従来法 比較例①	(イ) 熱間鍛造／圧延(900℃)→ (ロ) 溶体化処理(1,000℃)(水冷)→ (ハ) 時効処理(500℃×3H保持)	85
比較例②	(イ)→(ロ)→(ハ)→冷間鍛造(圧延30%)	85
比較例③ (2%以下の例)	(イ)→(ロ)→冷間鍛造／圧延(1%)→ (ハ)→冷間鍛造／圧延(1%)	85
比較例④ (50%を超える例)	(イ)→(ロ)→冷間鍛造／圧延(60%)→ (ハ)→冷間鍛造／圧延(30%)	84
本発明法 (1)	熱間鍛造／圧延(900℃)→ 溶体化処理(1,000℃)(水冷)→ 温間鍛造(30%加工率)／圧延(300℃) →時効処理(500℃×3H保持)→ 冷間鍛造(30%加工率)／圧延(室温)	85
本発明法 (2)	(イ)→(ロ)→ 冷間鍛造(30%)／圧延(室温)→ (ハ)→冷間鍛造(30%)／圧延(室温) →時効処理(450℃×1H保持)	85
本発明法 (3) (繰り返し1回)	本発明法(2)プラス→ 冷間鍛造(10%)／圧延(室温)	84
本発明法 (4) (繰り返し2回)	本発明法(3)プラス→ 時効処理(450℃×1H)→ 冷間鍛造／圧延(室温)(10%)	84

(注) Hは時間を意味する

Compared with the molding material manufactured by the conventional method, the molding material manufactured by this invention has very large hardness, and can say it as an ingredient with high toughness equipped with the elongation stabilized also at the elevated temperature so that clearly from the 1st table, and Fig. 1 or Fig. 3 .
If cold forging after the solution treatment of this invention method of the effect (rolling) is thin and exceeds 50% at 2% or less of the rate of cold working (working ratio means the percentage reduction of a cross-section area), hardness will not go up considering working ratio, but hardness will be

saturated. Moreover, forging (rolling) at the temperature of 500 degrees C or less and what is called warm forging (rolling) are sufficient as cold forging (rolling). Like cold forging after the aforementioned solution treatment (rolling), cold forging after aging treatment of the effect (rolling) is thin, and if 50% is exceeded, workability not only worsens with work hardening, but hardness will not go up it considering working ratio by 2% or less of the rate of cold working. Warm forging (rolling) of 500 degrees C or less is sufficient as cold forging (rolling) in this process.

[A supplement of an example and a comparative example]

It supplements with the example and comparative example at the time of manufacturing the copper plate for molds by the copper alloy ingredient which becomes below from each component (the 2nd table or the 6th table).

For example, chromium JIRUKONYUMU copper is well known as a precipitation-hardening type molding material, and, generally [the solution treatment temperature] Since 400-500 degrees C is suitable for 900-1000 degrees C and aging treatment temperature, unless it is shown in particular, in the following description, heat treatment carried out in a manufacture process is made into these conditions.

Moreover, the content or conditions of a code are carried out as follows.

(**) Hot forging/rolling (900 degrees C)

(**) Solution treatment (1000 degree C and water cooling)

(Ha) Aging treatment (500 degree-Cx3H)

HW: AG showing ST:solution treatment showing hot forging/rolling: Percentage reduction showing aging treatment of a (%) cross-section area (working ratio)

Moreover, electric conductivity shows %I.A.C.S.

第 2 表

0.8% Cr, Cu 残 の例

	製造方法	導電率
比較例① (従来法)	熱間鍛造／圧延(HW)(900℃) ↓ 溶体化処理(ST)(1,010℃)(水冷) ↓ 時効処理(AG)(490℃×3H)	90 %I.A.C.S.
比較例②	HW→ST→AG →冷間鍛造／圧延(30%)(室温)	90
比較例③ (2%以下の例)	HW→ST →冷間鍛造／圧延(1%)(室温)→ AG→冷間鍛造／圧延(1%)(室温)	90
比較例④ (50%を超える例)	HW→ST →冷間鍛造／圧延(60%)(室温)→ AG→冷間鍛造／圧延(30%)(室温)	90
本発明法 (1)	HW→ST →温間鍛造／圧延(30%)(300℃) →AG →冷間鍛造／圧延(20%)(室温)	90
本発明法 (2)	HW→ST →冷間鍛造／圧延(室温)(30%) →AG →冷間鍛造／圧延(室温)(20%) →AG(450℃×1H)	90
本発明法 (3) (繰り返し1回)	本発明法(2)プラス →冷間鍛造／圧延(室温)(10%)	89
本発明法 (4) (繰り返し2回)	本発明法(3)プラス →時効処理(450℃×1H) →冷間鍛造／圧延(室温)(10%)	89

第　3　表

Ni 1, Be 0.15, Zr 0.20, Mg 0.05, Cu 残の例（各%）

	製　造　方　法	導　電　率
比較例① （従来法）	熱間鍛造／圧延（HW）(850℃) ↓ 溶体化処理（ST）(900℃)（水冷） ↓ 時効処理（AG）(480℃×5H)	63 %I.A.C.S.
比較例②	HW→ST→AG →冷間鍛造／圧延(25%)（室温）	63
比較例③ （2%以下の例）	HW→ST →冷間鍛造／圧延(1%)（室温）→ AG→冷間鍛造／圧延(1%)（室温）	63
比較例④ （50%を超える例）	HW→ST →冷間鍛造／圧延(60%)（室温）→ AG→冷間鍛造／圧延(30%)（室温）	63
本発明法 （1）	HW→ST →温間鍛造／圧延(10%)(350℃) →AG →冷間鍛造／圧延(10%)（室温）	63
本発明法 （2）	HW→ST→ 冷間鍛造／圧延（室温）(10%) →AG →冷間鍛造／圧延（室温）(10%) →AG(450℃×2H)	63
本発明法 （3） （繰り返し1回）	本発明法（2）プラス →冷間鍛造／圧延（室温）(5%)	63
本発明法 （4） （繰り返し2回）	本発明法（3）プラス →時効処理(450℃×1H) →冷間鍛造／圧延（室温）(5%)	63

第 4 表

Ni 1.5, Be 0.3, Cu 残 の例 (各%)

	製造方法	導電率
比較例① (従来法)	熱間鍛造／圧延(HW)(850℃) ↓ 溶体化処理(ST)(900℃)(水冷) ↓ 時効処理(AG)(480℃×5H)	60 %I.A.C.S.
比較例②	HW→ST→AG →冷間鍛造／圧延(30%)(室温)	60
比較例③ (2%以下の例)	HW→ST →冷間鍛造／圧延(1%)(室温)→ AG→冷間鍛造／圧延(1%)(室温)	60
比較例④ (50%を超える例)	HW→ST →冷間鍛造／圧延(60%)(室温)→ AG→冷間鍛造／圧延(30%)(室温)	60
本発明法 (1)	HW→ST →温間鍛造／圧延(10%)(350℃) →AG →冷間鍛造／圧延(5%)(室温)	60
本発明法 (2)	HW→ST →冷間鍛造／圧延(室温)(5%) →AG →冷間鍛造／圧延(室温)(5%) →AG(400℃×3H)	59
本発明法 (3) (繰り返し1回)	本発明法(2)プラス →冷間鍛造／圧延(室温)(5%)	59
本発明法 (4) (繰り返し2回)	本発明法(3)プラス →時効処理(400℃×2H) →冷間鍛造／圧延(室温)(5%)	59

第 5 表

Ni 1.8, Si 0.7, Cu 残 の例（各%）

	製造方法	導電率
比較例①（従来法）	熱間鍛造／圧延（HW）（900℃） ↓ 溶体化処理（ST）（900℃）（水冷） ↓ 時効処理（AG）（450℃×3H）	50 %I.A.C.S.
比較例②	HW→ST→AG →冷間鍛造／圧延（35%）（室温）	50
比較例③（2%以下の例）	HW→ST →冷間鍛造／圧延（1%）（室温）→ AG→冷間鍛造／圧延（1%）（室温）	50
比較例④（50%を超える例）	HW→ST →冷間鍛造／圧延（60%）（室温）→ AG→冷間鍛造／圧延（30%）（室温）	50
本発明法（1）	HW→ST →温間鍛造／圧延（20%）（200℃） →AG →冷間鍛造／圧延（10%）（室温）	50
本発明法（2）	HW→ST →冷間鍛造／圧延（室温）（10%） →AG →冷間鍛造／圧延（室温）（10%） →AG（400℃×1H）	50
本発明法（3）（繰り返し1回）	本発明法（2）プラス →冷間鍛造／圧延（室温）（5%）	50
本発明法（4）（繰り返し2回）	本発明法（3）プラス →時効処理（400℃×1H） →冷間鍛造／圧延（室温）（5%）	50

第 6 表

Be 0.5, Co 2.5, Cu 残 の例 (各%)

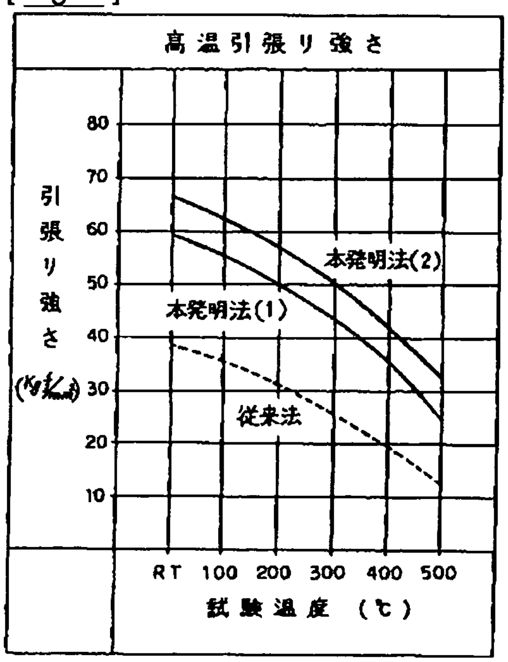
	製造方法	導電率
比較例① (従来法)	熱間鍛造／圧延(HW)(900℃) ↓ 溶体化処理(ST)(900℃)(水冷) ↓ 時効処理(AG)(450℃×3H)	52 %I.A.C.S.
比較例②	HW→ST→AG →冷間鍛造／圧延(30%)(室温)	52
比較例③ (2%以下の例)	HW→ST →冷間鍛造／圧延(1%)(室温)→ AG→冷間鍛造／圧延(1%)(室温)	52
比較例④ (50%を超える例)	HW→ST →冷間鍛造／圧延(60%)(室温)→ AG→冷間鍛造／圧延(30%)(室温)	52
本発明法 (1)	HW→ST →温間鍛造／圧延(20%)(200℃) →AG →冷間鍛造／圧延(10%)(室温)	52
本発明法 (2)	HW→ST →冷間鍛造／圧延(室温)(15%) →AG →冷間鍛造／圧延(室温)(15%) →AG(400℃×1H)	52
本発明法 (3) (繰り返し1回)	本発明法(2)プラス →冷間鍛造／圧延(室温)(10%)	52
本発明法 (4) (繰り返し2回)	本発明法(3)プラス →時効処理(400℃×1H) →冷間鍛造／圧延(室温)(5%)	52

[Effect of the Invention]

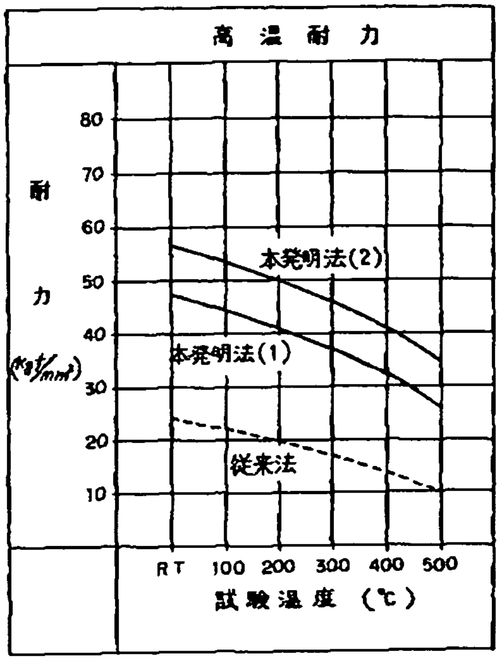
As explained above, in order according to this invention method for a betterment of remarkable hardness to be made by tensile strength, proof strength, stretch, etc. and not to add the third element which affects an ingredient at electric conductivity moreover compared with the case where it is based on a conventional method, Since an elevated temperature can just be borne if the charge of a casting which the decline in heat conductivity was not seen, therefore was manufactured by this invention method is applied to mold materials for continuous casting, such as steel, there is an outstanding effect that inconvenience, such as heat-resistant modification and a heat-resistant fatigue crack, can be prevented beforehand.

[Brief Description of the Drawings]
Fig. 1 or Fig. 3 is the curve chart which compared elevated-temperature tensile strength, high temperature proof stress, and elevated-temperature elongation, respectively about the mold material manufactured by this invention method, and the mold material manufactured by the conventional method.

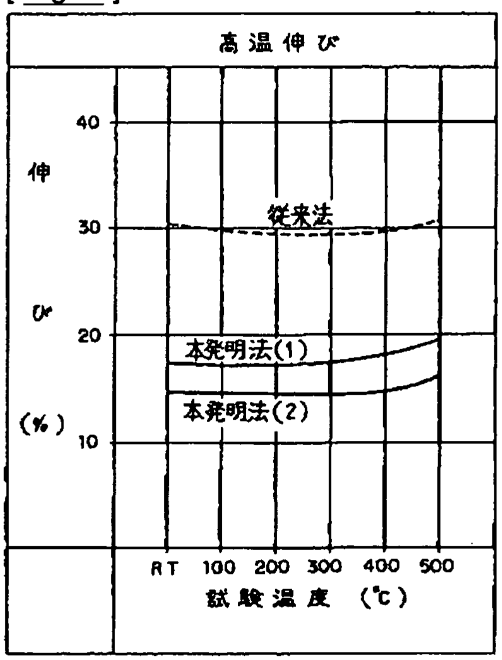
[Fig. 1]



[Fig. 2]



[Fig. 3]



[Translation done.]